

# AggieSat: Autonomous Rendezvous and Docking Technology Demonstrator, Phase I

Completed Technology Project (2009 - 2010)



## Project Introduction

Current autonomous rendezvous and docking (AR&D) capability in low Earth orbit (LEO) is constrained by sensor and effector mass, power, and accuracy limits. To this end, NASA Johnson Space Center has developed a GPS receiver, called DRAGON (Dual RF Astrodynamic GPS Orbital Navigator), specifically to address the sensor constraints. The proposed innovation includes creating a small, low-cost, and versatile technology demonstrator to validate and increase the technology readiness level of DRAGON and other state-of-the-art miniaturized sensors and effectors in an on-orbit AR&D operational scenario. For Phase 1, a demonstration platform will be developed that utilizes two picosatellites in LEO, and relative GPS as the primary sensor. These satellites will be launched as a single unit from the SSPL (Space Shuttle Payload Launcher) on STS 127, then separate and transmit DRAGON GPS data. The picosatellite technology demonstrator will be at a TRL of 7 at the end of Phase 1. For Phase 2, the demonstration platform will be further developed to further validate DRAGON, and validate IMU sensors, a 1st generation reaction control system, a 1st generation guidance navigation and control system, communication links, and an undocking mechanism.

## Anticipated Benefits

The validated miniaturized sensors and effectors will be applicable to a variety of missions for DoD, companies, and universities, and the demonstrator platform itself will be plug and play, and available and adaptable to other mission validations. As an example, PM+AM Research has been working in laser-based micro-space propulsion with the AFRL Space Propulsion Directorate for many years, which has led to a number of applications of distributed systems based on picosats. Our concept will help realize such distributed systems. The communities with immediate interest include: responsive space, midcourse ballistic missile defense, and space situational awareness. PM+AM Research is working with DoD in each of these, and a suitable platform for specific test scenarios will allow us to perform test and evaluation measurements/scenarios attractive to these customers. These anticipated development efforts are expected to lead to follow-on efforts and eventual products, which may require the involvement of the large integrators.



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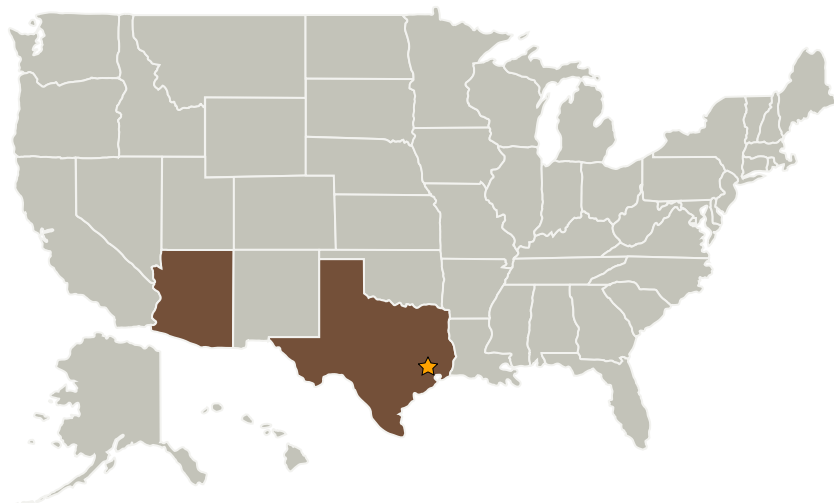
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## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Physics, Materials, and Applied Mathematics Research, LLC	Supporting Organization	Industry	Tucson, Arizona
Texas A&M Engineering Experiment Station(TEES)	Supporting Organization	Academia	College Station, Texas

### Primary U.S. Work Locations

Arizona	Texas
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## Project Transitions

**January 2009:** Project Start

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Center / Facility:

Johnson Space Center (JSC)

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Project Manager:

Robert S Provence

### Principal Investigator:

Helen Reed

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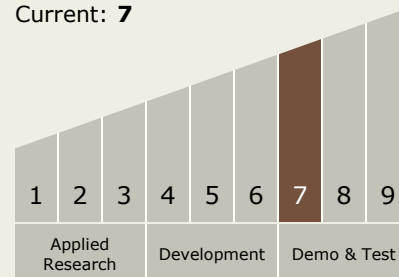
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**January 2010:** Closed out

### Technology Maturity (TRL)

Start: 7  
Current: 7



### Technology Areas

#### Primary:

- TX17 Guidance, Navigation, and Control (GN&C)
  - └ TX17.4 Attitude Estimation Technologies
    - └ TX17.4.3 Attitude Estimation Sensors